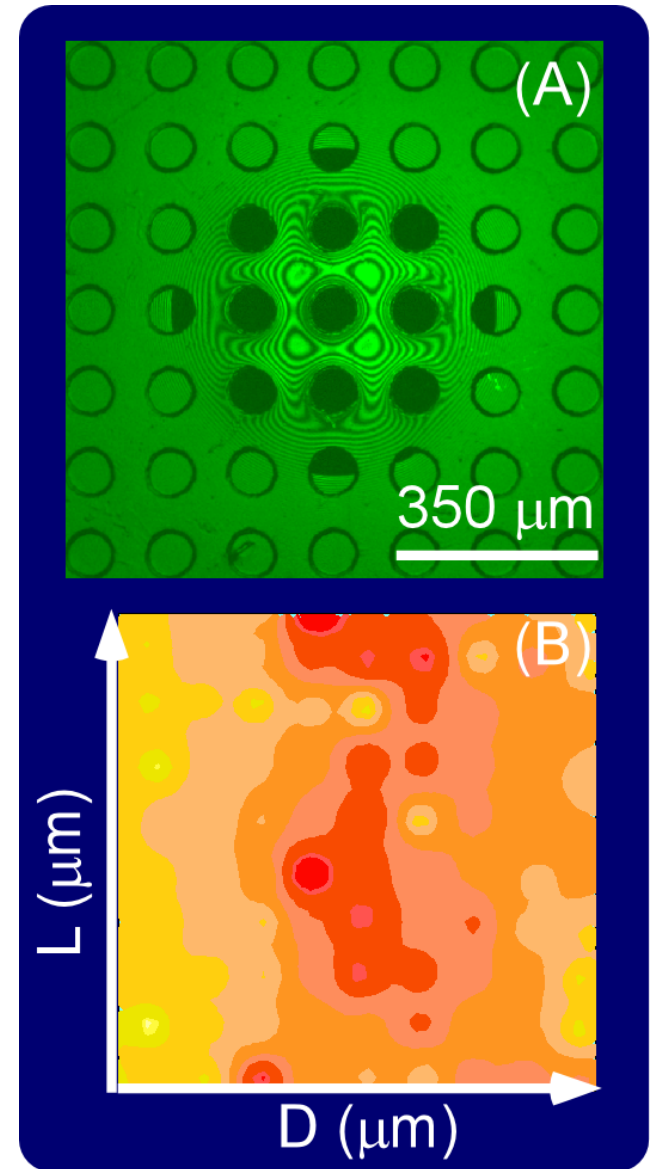


# “Smart” Adhesion: Controlling Polymer Interfaces with Patterns

Alfred J. Crosby, University of Massachusetts, DMR-0349078

Nature often uses patterning on micron and nanometer length scales to systematically tailor performance (e.g. gecko, jumping spider, lotus leaf). To understand how patterns can be used to control polymer adhesion and release, we fabricate controlled structures on polymer surfaces and measure their adhesion by contact adhesion tests conducted on a custom-designed, sub-nanometer precision instrument. Initial results demonstrate the effect of patterned “pancakes” and holes on the adhesion of polydimethylsiloxane. This approach allows us to visualize the contact “history” (Figure A) and precisely quantify the adhesion of the patterned interface. For this material and initial patterns, we control different adhesion descriptors from 50% to 400% the value of conventional non-patterned interfaces. Figure B illustrates the tuning of adhesion energy per unit area as a function of “pancake” spacing ( $L$ ) and “pancake” diameter ( $D$ ).



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## Education and Outreach

In addition to supporting the research of three Ph.D. candidates and three undergraduate researchers over the past year, this NSF grant has been used to develop a new course focused on training science-related graduate students in “soft” skills and management strategies. Topics include:

- Leadership qualities
- Proposal writing
- Group Management
- Communication in Diverse Environments
- Entering the Academic Job Process

In the course’s first year, it’s students ranged over 4 departments, over 50% women, and numerous ethnic backgrounds.



“The interactive nature of the class, the interesting readings, your guidance and the candid panel discussion, made it one of the best courses I have taken.”  
-- Graduate Student, Dept. of Physics